IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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J. Mitchell
11/10/02

Applicants:	Robert M. Hilton and Sabran B. Samsuri		
Assignees:	Celerity Research Pte. Ltd. and ASE Electronics (M) Sdn. Bhd.		
Title:	Flip-Chip Package With Underfill Dam That Controls Stress at Chip Edges		
Serial No.:	09/683,303	Filing Date:	December 11, 2001
Examiner:	J. Mitchell	Group Art Unit:	2827
Docket No.:	MTB001US		

San Jose, California
November 1, 2002

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

RESPONSE TO OFFICE ACTION

Dear Sir:

This is a response to the August 1, 2002 Office Action, which has a statutorily shortened period for response that ends November 1, 2002.

Please amend the above-identified application as follows.

IN THE SPECIFICATION

Please amend the specification to include the following paragraphs. In accordance with 37 C.F.R. § 1.121(b)(1)(iii), marked up versions of replacement paragraphs are on one or more separate pages accompanying this response.

Please replace paragraph **[0004]** with the following amended paragraph.

[0004] One concern in flip-chip packages is the difference between the coefficients of thermal expansion of semiconductor die 110 and substrate 130. This difference creates mechanical displacement stress on the connections between die 110 and substrate 130. In packaged device 100, underfill 120 between die 110 and substrate 130 strengthens the attachment of die 110 to substrate 130 to help prevent the thermal stresses from breaking the connections between die 110 and substrate 130.

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Please replace paragraph **[0013]** with the following amended paragraph.

[0013] Another embodiment of the invention is a method for packaging an integrated circuit die. The method includes: attaching the die to a substrate so that conductive traces on the substrate electrically contact contacts on the die; forming a dam on the substrate around the die; and filling a volume between the die and the substrate and between the die and the dam with an underfill material. The dam can be constructed before applying the underfill by placing, depositing, growing, or otherwise accumulating material on the substrate to form the dam. Alternatively, the dam can be preformed to the desired shape and attached to the substrate. The underfill is applied after the dam is in place so that the dam controls the shape and location of the edge of the underfill. Suitable materials for such dams include but are not limited to a material such as a metal layer or feature and a polymer which is filled with property modifying materials such as spheres, fibers or pieces of quartz, ceramic, or metal.

Please replace paragraph **[0024]** with the following amended paragraph.

[0024] Dam 240 can be formed on or attached to substrate 230 using a variety of techniques. For example, suitable dam forming techniques include but are not limited to liquid dispense methods, injection transfer molding, and thermocompression transfer molding. Alternatively, dam 240 can be a preformed organic or metallic structure that is formed into the desired shape and then attached to substrate 240 by gluing, staking, or riveting. In one particular embodiment, dam 240 doubles as a stiffener or heat spreader that attaches to substrate 130 to improve the mechanical or thermal properties of packaged device 200. Co-filed patent application No. 09/683,304, entitled "Adhesive Control During Stiffener Attachment To Provide Co-Planarity In Flip Chip Packages", further describes attachment of a stiffener and is hereby incorporated by reference in its entirety.

Please replace paragraph **[0026]** with the following amended paragraph.

[0026] Generally, the volume of underfill and the height and shape of dam 240 should be selected to ensure that a wetting angle α' of underfill 220 is less than 45 ° (maximum) from the top surface of die 110 as shown in Fig. 2B. The underfill wetting angle α'' to dam 240

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